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NASA, Europe find ozone loss over Arctic

While areas of the United States experienced days of record warm temperatures this past winter, NASA Langley scientists found record cold in the Arctic stratosphere. These cold temperatures contributed to more than 60 percent ozone loss - one of the worst ever reported at this altitude near the North Pole.

According to reports from NASA's SAGE III Ozone Loss and Validation Experiment (SOLVE) and the European Commission-sponsored Third European Stratospheric Experiment on Ozone (THESEO) 2000, large ozone losses were observed inside the Arctic stratospheric polar vortex. The polar vortex is a large, swirling air mass with its thickest layer of ozone near 60,000 feet.

Six teams of NASA Langley scientists studied and sampled the vortex in what was the largest field campaign ever to study North Pole ozone loss. With an international team of researchers based in Kiruna, Sweden, above the Arctic Circle, the joint study involved 350 scientists, technicians and support personnel from the U.S., Canada, Europe, Russia and Japan.

Dr. Edward Browell, NASA Langley's principle investigator with the UV Differential Absorption LIDAR (DIAL) instrument helped collect data over the ozone region and says it is the most extensive information compiled to date.

"We provided the bigger perspective on the ozone loss and the distribution of polar stratospheric clouds over the whole vortex," said Browell. "Ours was the prime instrument making the spatial extent of the ozone loss."

The UV DIAL along with many other instruments flew aboard NASA's DC-8 based at NASA Dryden Flight Research Center, Edwards, Calif. The UV DIAL sent pulses of laser light above the flying laboratory and was tuned to "see" absorption of ozone.

"We actually sent six laser beams above the plane," Browell added. "Different beams can get information about the particles and the clouds through the important part of the ozone layer or where the bulk of the ozone resides."

The four-month experiment, begun in November 1999, focused on the puzzling balance of ozone production, loss, and its movement in the lower Arctic stratosphere from early winter to spring.

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Analysis of ozone and other atmospheric gases will show how the stratosphere's chemical composition changed through the Arctic winter. The SOLVE campaign hoped to identify the processes that control ozone concentrations. In turn, scientists hope to better understand the composition of polar stratospheric clouds (PSCs) and the chemical reactions involved in ozone loss on the surfaces of these cloud particles.

The polar stratosphere temperatures were extremely low over this last winter, and PSCs can only form in these low temperature regions. Browell added that the PSCs' surface serves to convert chlorine gases in the upper atmosphere from a benign or passive state to an active state that contributes to ozone depletion.

"We're documenting the chemical loss of ozone over the Arctic as a result of the PSCs," he said. "So, with the Langley instrument, it helped to show how widespread they are and the clouds' characteristics."

It was also the first time they were allowed to fly in the coldest regions over Russia.

"Until this mission we haven't had permission," Browell said. "But it's critical to have this important data to study these clouds."

The DC-8 flew its first mission over Russia's Franz Josef Land during SOLVE's first phase last December. Another flying laboratory based at NASA Dryden, NASA's high-flying ER-2 (a modified design of Lockheed's U-2) completed its first science flight though Russian airspace in conjunction with the DC-8 in January.

Browell, a NASA Langley employee since 1974, has flown DIAL systems all over the world for 20 years.

"It was an exciting experiment," he added. "We got to see the whole process from start to finish, and we pretty much nailed it. It was a very good mission and timed just right."

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For still or video images of the SOLVE project or mission results, contact the NASA Langley Research Center, Hampton, Va., at the phone number listed above.

For more information on atmospheric sciences see: http://asd-www.larc.nasa.gov/ceres/ASDceres.html or for more information on SOLVE, see: http://cloud1.arc.nasa.gov/solve/index.html or for THESEO 2000, see: http://www.ozone-sec.ch.cam.ac.uk or http://www.nilu.no/projects/theseo2000. A media guide for SOLVE can be downloaded from http://george.arc.nasa.gov/dx/basket/factsheets/FS991103.html.